ENGINEERING CHANGE NOTICE

1. ECN 643401

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental JB ~~[X]~~ Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	J. G. Field, LMHC, R2-12, 376-3753	[] Yes [X] No	08/14/97
	6. Project Title/No./Work Order No. Tank 241-B-202	7. Bldg./Sys./Fac. No. NA	8. Approval Designator NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-371, Rev. 0	10. Related ECN No(s). NA	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change 13b. Design Baseline Document? [] Yes [X] No

Add Appendix D, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-B-202.

14a. Justification (mark one)

Criteria Change	[]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[X]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities. As part of this effort, an evaluation of available information for single-shell tank 241-B-202 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

15. Distribution (include name, MSIN, and no. of copies)

Central Files	A3-88	K. M. Hall	R2-12
DOE Reading Room	H2-53	K. M. Hodgson	R2-11
TCSRC	R1-10	R. T. Winward	H5-49
File	H5-49	L. L. Buckley	R2-12
J. G. Field	R2-12		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

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DATE: HANFORD RELEASE

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 643401

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. M. J. Kupfer *MJ Kupfer*	8-15-97	PE	
Cog. Mgr. K. M. Hodgson *K.M. Hodgson*	8-18-97	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other L. L. Buckley *L. Buckley*	8-18-97	Other	

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-B-202

J. G. Field, K. M. Hodgson, and R. T. Winward (Meier Associates)
Lockheed Martin Hanford Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities. As part of this effort, an evaluation of available information for single-shell tank 241-B-202 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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Janis Bishop 8-20-97
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Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-371	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-B-202

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 08/08/95 on EDT 612175.	M. J. Kupfer	K. M. Hodgson
0A RS	Incorporate per ECN-643401.	M. J. Kupfer	K. M. Hodgson
		MJ Kupfer 8-15-97	K.M. Hodgson 8-18-97

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-202

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-202

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for single-shell tank 241-B-202 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

The information provided in Section 4.0 of this tank characterization report (TCR) includes characterization results from the 1991 core sampling event for this tank (Pool 1994). Two core samples were obtained and analyzed.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Sample-based inventories listed in Tables D2-1 and D2-2 were calculated by multiplying the mean concentration of an analyte by the current tank volume and by the mean density of the waste. (The chemical species are reported without charge designation per the best-basis inventory convention). The tank is reported to contain 102 kL (27 kgal) sludge (Hanlon 1997), and the mean density is reported to be 1.21 g/mL. The Hanford Defined Waste (HDW) model-based inventory (Agnew et al. 1997a) is derived using this same waste volume and density.

Table D2-1. Sample- and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components for Tank 241-B-202.

Analyte	Sampling[a] inv. estimate (kg)	HDW[a] inv. estimate (kg)	Analyte	Sampling[a] inv. estimate (kg)	HDW[b] inv. estimate (kg)
Al	120	0.00	Ni	24.6	8.54
Bi	4,000	1,190	NO_2	67.0	15.1
Ca	191	1,000	NO_3	7,740	7,760
Cl	102	85.9	OH	763	1,910
Cr	296	32.1	P as PO_4	1,100	815
F	763	1,960	S as SO_4	172	26.2
Fe	800	2,070	Sr	71.0	0
Hg	0.04	0	TIC as CO_3	221	1,500
K	811	821	TOC	346	2,600
La	1,610	48.0	U_{TOTAL}	26.4	7.84
Mn	1,606	25.5	H_2O (wt%)	76.0	68.6
Na	4,540	9,950	density (kg/L)	1.21	1.21

HDW = Hanford Defined Waste
[a] Pool (1994)
[b] Agnew et al (1997a).

Table D2-2. Sample- and Hanford Defined Waste-Based Inventory Estimates for Radioactive Components in Tank 241-B-202.

Analyte	Sampling[a] inv. estimate (Ci)	HDW[b] inv. estimate (Ci)	Analyte	Sampling[a] inv. estimate (Ci)	HDW[b] inv. estimate (Ci)
^{90}Sr	449	17.6	$^{239/240}Pu$	25	487
^{137}Cs	3.1	19.9	^{241}Am	7.89	3.66 E-04

HDW = Hanford Defined Waste
[a] Pool (1994), decayed to January 1, 1994
[b] Agnew et al (1997a), decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation provides a best-basis inventory estimate for the chemical and radionuclide components in tank 241-B-202.

D3.1 CONTRIBUTING WASTE TYPES

The following abbreviations were used to designate waste types:

224	=	LaF_3 final plutonium decontamination and concentration waste from the $BiPO_4$ process
1C	=	First decontamination cycle $BiPO_4$ waste, operational 1944 to 1956.

Agnew et al. (1997b) first shows waste in the 200 series tanks in 1952 for B and T Tank Farms, and in 1956 for U Tank Farm. However, Borsheim (1994) reports that originally the 224 wastes were routed to the 6.1 m (20 ft) diameter concrete settling tank (241-361) and overflowed from there to a dry well. The dry well was replaced by a crib by June 1945.

Cell drainage (5-6 waste) was also routed to the 241-361 tank. High activity cell drainage was supposed to be routed to tanks 241-B-107 and 241-T-107 in the 1C waste cascades. Borsheim (1994) also notes that each of the B and T Tank Farm series tanks were provided with two inlet lines, were not cascaded, and had no overflow lines. Experiments (as of November 1944) indicated that the 224 wastes should contain 3 percent solids by volume.

Borsheim (1994) notes that the "Hanford Works Monthly Reports" show a plan to provide a separate crib for the B Plant cell drainage. The cell drainage was then being disposed of to the 241-B-201 tank along with the 224 waste. The 241-B-201 and 241-T-201 tanks were in service as sludge settling tanks for 224-B and T wastes, respectively. The remaining B and T Tank Farm 200 series tanks (202, 203, 204) were being excavated and piped in series to increase settling capacity.

Borsheim (1994) reports that by July 1950, tank 241-B-204, which had been in service since November 1948, was filled to a depth of 6.1 m (20 ft) with sludge. The tank overflowed to tank 241-B-203 that had received 10.6 cm (4 in.) of sludge by that time. This suggests that tanks 241-B-201 and 241-T-201 received 224 waste before the other B-200 and T-200 series tanks, and that when the other B-200 series tanks received waste, it overflowed from 241-B-204 to 241-B-203 and then to 241-B-202. The T-200 series tanks received 224 waste in a similar fashion.

The waste volumes in tanks 241-B-204, 241-B-203, and 241-B-202 are 189 kL (50 kgal), 193 kL (51 kgal), and 102 kL (27 kgal) respectively (Hanlon 1997). Tank

241-B-201 contains 110 kL (29 kgal) and is piped separately from the other B-200 tanks, indicating that it received waste independent of the other three B-200 series tanks. The T-200 series tank waste volumes show the same trends.

Expected Types of Solids in the Waste

Hill et al. (1995): 224
Agnew et al. (1997a): 224

D3.2 EVALUATION OF FLOWSHEET INFORMATION

Technical flowsheet information (Kupfer et al. 1997) for 224 streams is shown in Table D3-1. The comparative HDW model waste streams are also shown in this table.

Table D3-1. Technical Flowsheet and Hanford Defined Waste Defined Waste Streams.

Analyte	Place flowsheet 224[a] (*M*)	Schneider flowsheet 224[a] (*M*)	HDW 224[b] (*M*)
Bi	0.00595	0.00565	0.006
C_2O_4	0.0458	0.0147	0.046
Cr	0.00362	0.00327	0.0068
F	0.272	0.295	0.27
K	0.223	0.218	0.231
La	0.00376	0.00353	0.0038
Mn	0.00514	0.00601	0.0051
Na	1.62	1.60	1.60
NO_3	1.06	0.684	1.38
PO_4	0.0322	0.0321	0.038
SO_4	0.00140	0.00364	0.003
NH_4	NR	0.0067	NR

HDW = Hanford Defined Waste
NR = Not reported
[a] Appendix C of Kupfer et al. (1997)
[b] Agnew et al. (1997a).

D3.3 ASSUMPTIONS FOR RECONCILING WASTE INVENTORIES

Reference inventories of certain components in tank 241-B-202 were estimated using an engineering assessment that is based on a set of simplified assumptions. The inventories were then compared with the tank 241-B-202 sample-based inventories and the HDW model inventories. The assumptions and observations for the engineering assessment were based on best technical judgement pertaining to input information that can significantly influence tank inventories. This includes: (1) correct prediction of contributing waste types, and correct relative proportions of the waste types, (2) accurate predictions of flowsheet conditions, fuel processed, and waste volumes, (3) accurate prediction of partitioning of components, and (4) accurate predictions of physical parameters such as density, percent solids, etc. By using this evaluation, the assumptions can be modified as necessary to provide a basis for identifying potential errors and/or missing information that could influence the sample- and model-based inventories. The following are simplified assumptions and observations used for this evaluation.

- Tank waste mass is calculated using a measured density of 1.21 g/mL and a tank volume of 102 kL (27 kgal). Both the analytical-based and the model-based inventories were derived using this volume and density.

- Only the 224 stream contributed to solids formation. It is assumed that tanks with the same waste type will have the same concentrations of individual analytes.

- Bulk component information is sufficient for comparing analytical and predicted data sets. This information can be obtained from technical flowsheets (Table D3-1).

- No radiolysis of NO_3 to NO_2 and no additions of NO_2 to the waste for corrosion purposes are factored into this evaluation.

- Bi, Cr, F, La, Mn, PO_4, and SO_4 precipitate.

- NO_3, K, C_2O_4, and Na remain dissolved in the interstitial liquid.

- Only the 224 waste stream contributes to the interstitial liquid.

- Concentration of components in the interstitial liquid is based on a void fraction of 0.885 as reported by Agnew et al. (1997a).

D3.4 BASIS FOR CALCULATIONS USED IN THIS ENGINEERING EVALUATION

The sample analysis data was assumed to be correct for tank 241-B-202. A throughput or concentration factor (CF) was derived. With the CF and the HDW reported porosity (0.885) the total inventory of those analytes that are listed in the 224 facility waste stream flowsheets can be calculated. This information can then be applied to the other tanks to see if derived inventories closely match analytical data. If they do, then the analytical data and these factors must be correct. If reasonable matches do not occur, the assumptions and information regarding this waste are incorrect and/or incomplete, and another approach is necessary.

D3.4.1 THROUGHPUT OR CONCENTRATION FACTOR

The CF was derived using a flowsheet component that is assumed to be 100 percent insoluble and 100 percent contained in the tank. The CF was determined by dividing the inventory found in the sample analysis by the inventory in the original waste stream (from the flowsheet). The CF factor was calculated as follows:

CF = sample inventory (kg) ÷ flowsheet inventory for the original waste stream (kg)

This CF was used to calculate inventories for all analytes that precipitate in the tank. If the CF is valid and the assumptions regarding the process history of the waste, the flowsheet, and the analytical data are correct; then inventories predicted by this investigation should be close to those reported in the analytical data, and tanks with the same waste type should have the same CF. Concentration factors for the B-200 series tanks are presented in Table D3-2.

Table D3-2. Concentration Factors for 224 Waste in Tanks 241-B-201, 241-B-202, 241-B-203, and 241-B-204.

Analyte	Tank 241-B-201[a]	Tank 241-B-202[b]	Tank 241-B-203[c]	Tank 241-B-204[d]
Bi	95	31	39	45
Cr	22	15	19	20
F	0.35	1.45	1.80	1.62
K	0.83	0.91	0.71	0.78
La	36	30	23	23
Mn	85	56	58	61
Na	1.28	1.19	0.93	0.83
NO_3	0.94	1.15	1.15	0.95
PO_4	6.83	3.50	1.48	2.72
SO_4	3.24	12.57	6.17	5.74

[a] Based on Data From Conner et al. (1997)
[b] Based on Data From Section 4.0 of this Tank Characterization Report
[c] Based on Data From Jo et al. (1996)
[d] Based on Data From Sasaki et al. (1996).

A comparison of the concentration factors indicates that the three tanks that were connected in series by the lines (241-B-204, 241-B-203, and 241-B-202) are similar, but the tank that was filled separately (241-B-201), is different for several analytes.

D3.4.2 SAMPLE CALCULATIONS USED IN THIS ENGINEERING EVALUATION

Flowsheet inventories for components assumed to precipitate (e. g., Bi and Mn) and components assumed to remain dissolved in the interstitial liquid (e. g., NO_3, K, C_2O_4, and Na) were calculated as follows:

Components assumed to precipitate (Bi, Cr, F, La, Mn, PO_4, SO_4)

$kg_{analyte}$ = $Moles_{analyte}/L_{224}$ x 102,000 L x $g/mole_{analyte}$ x $CF_{analyte}$ x kg/1,000 g

Components Assumed to remain dissolved in the interstitial liquid (NO_3, K, C_2O_4, Na)

$kg_{analyte}$ = $Moles_{analyte}/L_{224}$ x $0.885_{porosity}$ x 102,000 L x $g/mole_{analyte}$ x kg/1,000 g

Estimated component inventories from the flowsheet evaluation are compared with sample- and HDW model-based inventories for selected components in Table D3-3. Observations regarding these inventories are noted, by component, in the following text.

Table D3-3. Comparison of Selected Component Inventory Estimates for Tank 241-B-202 Waste. (2 Sheets)

Component	This evaluation (kg)	Sample-based[a] (kg)	HDW estimated[b] (kg)
C_2O_4	365	NR	9,550
Bi	3,930	4,000	1,190
K	787	811	821
La	1,600	1,606	48.0
NO_3	5,930	7,740	7,760
Mn	1,610	1,610	25.5
SO_4	172	172	26.2
Cr	289	296	32.1
PO_4	1,100	1,100	815
F	764	763	1,960

Table D3-3. Comparison of Selected Component Inventory Estimates for Tank 241-B-202 Waste. (2 Sheets)

Component	This evaluation (kg)	Sample-based[a] (kg)	HDW estimated[b] (kg)
Na	3,360	4,540	9,950
H_2O (%)		76.0	68.6

HDW = Hanford Defined Waste
NR = Not reported
[a]Pool (1994)
[b]Agnew et al. (1997a).

Bismuth. This evaluation assumed Bi to precipitate 100 percent. Bismuth was used to determine the CF for this waste tank. This was accomplished by determining what CF would be necessary to bring the waste stream concentration, multiplied by the total waste volume, into agreement with the sampling data. This biases the data to match the sampling results for this one analyte. However, when this CF is used for the other insoluble analytes, the results largely agree with the sampling data, indicating the CF is near the true CF for this tank. The sample-based inventory is roughly the same as the flowsheet estimate, and the HDW estimated inventory appears smaller, by about a factor of three.

Nitrate. The HDW estimated inventory is similar to the sample-based inventory, and both of these are larger than the flowsheet inventory estimated in this evaluation. The results of the engineering evaluation differ from the sampling analytical results by about 23 percent. The inventory derived in this evaluation may be low because it does not take into account any radiolysis of NO_3 to NO_2.

Sulfate. The HDW estimated inventory is smaller than the sample-based inventory and the flowsheet estimate. The lower HDW values may be attributed to solubility assumptions in the model.

Chromium. The HDW estimated inventory is lower than the sample-based inventory or the estimate from this evaluation. A Cr corrosion source term is not included in these calculations. All four B-200 tank results show good agreement between the sample-based data and the flowsheet analysis, with HDW reporting about 10 times less Cr. It appears that a combination of underestimating the total flow through the tanks and solubility assumptions in the model cause HDW to underestimate the Cr inventory.

Phosphate. The flowsheet inventory does not account for any potential dilution by water or other dilute waste streams. Nevertheless, the flowsheet and sample-based inventories agree, and the HDW model inventory is slightly lower.

Fluoride. The analytical sample inventory and the flowsheet inventory estimate are based on water soluble F only. Both of these estimates are lower than the HDW inventory.

There is a difference of opinion as to how much if any insoluble fluoride exists in the tank. Until total F is analyzed, this question can not be answered. Consequently, the flowsheet analysis may under estimate the F content of tank 241-B-202, even though it generally matches the analytical data.

Sodium. The Na flowsheet values are slightly lower than the sample analysis values and three times lower than the HDW model values. Differences in the HDW model are attributed to solubility assumptions.

Oxalate. Oxalate was not measured in the analytical samples for tank 241-B-202. However, for tanks in which oxalate was measured, the HDW value was significantly higher than sample results. The flowsheet results appear to resemble the sample results more closely than the HDW model.

Potassium. The soluble analytes such as potassium agree closely for sample results, the flowsheet analysis and HDW model estimates. This indicates that the HDW model predicts the potassium solubility fairly well for this tank.

Lanthanum. Lanthanum appears to partition between the phases in the tank. Lanthanum from this evaluation matches the sample analysis data much more closely than the HDW model. The HDW model value for La is much lower, probably due to solubility assumptions in the model.

Manganese. Flowsheet values for manganese are in good agreement with the sample analytical data. The HDW model treats manganese as highly soluble and predicts significantly less manganese in the waste.

Total Hydroxide. Sample analyses showed a value of 763 kg for the total hydroxide in tank 241-B-202. This is lower than the inventory based on a charge balance (4,440 kg) and the HDW model estimate of 1,910 kg. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

Comments On Other Analytes

Strontium. The HDW model assumes there is no strontium in the 224 waste. However, some strontium was measured by the sample analysis.

Aluminum. The HDW model reports no Al in any of the 241-B-200 series tanks. The sampling-based data shows an inventory of 120 kg for tank 241-B-202.

Nickel. The amount of Ni reported in the sample-based and HDW inventories varies by about a factor of three for tank 241-B-202.

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D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities and to address regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities include designing equipment, processes, and facilities for retrieving wastes, and processing them into a form suitable for long-term storage/disposal.

Chemical and radiological inventory information are generally derived using three approaches: (1) component inventories are estimated using the results of sample analyses or data from similar tanks, (2) component inventories are predicted using the HDW model based on process knowledge and historical information, or (3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data. The information derived from these different approaches is often inconsistent.

As part of this effort, an evaluation of available chemical information for tank 241-B-202 was performed, including the following:

- Data from two 1995 core samples (Pool 1994).
- An inventory estimate generated by the HDW model (Agnew et al. 1997a).
- Flowsheet information and estimating CF for analytes in tanks 241-B-201, 241-B-202, 241-B-203, and 241-B-204.

The calculations based on flowsheet information and factors determined from the bismuth analytical data from tank 241-B-202 have been compared to analytical data and the HDW model. The flowsheet calculations compare well with the analytical data and, in some cases, with the HDW model.

The best source of inventory data appeared to be the analytical data which was obtained during the 1995 core sampling and analysis event. One analyte, for which the analytical data is suspect, is fluoride. Only the water soluble forms of fluoride are reported in the analytical data, because water insoluble fluoride was not measured. Tables D4-1 and D4-2 present the best-basis inventory estimates for the nonradioactive and radioactive waste components, respectively. The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am, etc., have been infrequently reported. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997, Section 6.1 and in Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks are reported in the HDW Rev. 4 model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. (No attempt has been made to ratio or normalize model results for all 46 radionuclides when values for measured radionuclides disagree with the model.) For a discussion of typical error between model derived values and sample derived values (see Kupfer et al. 1997, Section 6.1.10). The radionuclide inventories shown in Table D4-1 are based primarily on HDW model estimates for tank 241-B-203.

Table D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-202 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, C, or E)[1]	Comment
Al	120	S	
Bi	4,000	S	
Ca	191	S	
Cl	102	S	
TIC as CO_3	221	S	
Cr	296	S	
F	763	S	Only the water soluble forms of fluoride are reported in the analytical data.
Fe	800	S	
Hg	0.04	S	
K	811	S	
La	1,610	S	
Mn	1,606	S	
Na	4,540	S	
Ni	24.6	S	
NO_2	67	S	
NO_3	7,740	S	
OH_{TOTAL}	4,440	C	Calculated based on charge balance.
P as PO_4	1,100	S	
Pb	77	S	
S as SO_4	172	S	
Si	400	S	
Sr	71.0	S	
TOC	346	S	

Table D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-202 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, C, or E)[1]	Comment
U_{TOTAL}	26.4	S	
Zr	0.7	S	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997a)
E = Engineering assessment-based
C = Calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-202 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	5.43 E-04	M	
^{14}C	1.68 E-04	M	
^{59}Ni	4.78 E-05	M	
^{60}Co	5.40 E-05	M	
^{63}Ni	0.00441	M	
^{79}Se	3.55 E-05	M	
^{90}Sr	449	S	
^{90}Y	449	S	Based on ^{90}Sr
^{93m}Nb	1.39 E-04	M	
^{93}Zr	1.69 E-04	M	
^{99}Tc	0.00117	M	
^{106}Ru	4.05 E-11	M	
^{113m}Cd	4.72 E-04	M	
^{125}Sb	6.23 E-05	M	
^{126}Sn	5.35 E-05	M	
^{129}I	2.21 E-06	M	
^{134}Cs	2.68 E-06	M	
^{137m}Ba	2.9	S	Based on ^{137}Cs
^{137}Cs	3.1	S	
^{151}Sm	0.134	M	
^{152}Eu	1.76 E-04	M	
^{154}Eu	8.67 E-04	M	
^{155}Eu	0.0159	M	
^{226}Ra	7.93 E-09	M	
^{227}Ac	4.18 E-08	M	
^{228}Ra	5.10 E-13	M	
^{229}Th	9.86 E-11	M	
^{231}Pa	9.65 E-08	M	

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-202 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}Th	4.45 E-14	M	
^{232}U	5.17 E-08	M	
^{233}U	2.36 E-09	M	
^{234}U	0.00258	M	
^{235}U	1.15 E-04	M	
^{236}U	2.25 E-05	M	
^{237}Np	7.24 E-06	M	
^{238}Pu	3.09 E-04	M	
^{238}U	0.00262	M	
$^{239/240}Pu$	25	S	
^{241}Am	7.89	S	
^{241}Pu	0.013	M	
^{242}Cm	3.57 E-06	M	
^{242}Pu	6.01 E-08	M	
^{243}Am	2.97 E-09	M	
^{243}Cm	7.70 E-08	M	
^{244}Cm	7.56 E-08	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997a)
E = Engineering assessment-based.

D5.0 APPENDIX D REFERENCES

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